

REMARKS

Applicants respectfully request favorable reconsideration of this application, as amended.

Claims 1, 3, 4, and 7 have been cancelled, and Claims 2 and 6 have been amended. Claims 8 and 9 have been added. Accordingly, Claims 2, 5, 6, and 8-9 are pending in the application.

Claim 2 has been rewritten in independent form, with some modification of the limitations from the base claim. It is believed that this amendment removes the basis for the objections to Claim 2 and Claim 6 dependent therefrom.

Claims 1 and 4 were rejected under 35 U.S.C. § 102(b) as being anticipated by Sadakata et al. (U.S. Patent 5,916,026). In view of the cancellation of Claims 1 and 4, this rejection is now moot. Likewise, the objections to Claims 1 and 4 are also moot.

Claims 3 and 5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadakata et al. (U.S. Patent 5,916,026). Claim 3 has been cancelled. Reconsideration of the rejection of Claim 5 is respectfully requested.

Claim 5 is a method claim defining a method of manufacturing a coupling element including the step of forming the stopper portions on a hollow shaft member by

forming the stopper portions on a hollow shaft member by forming the stopper portions into the shape of a flange while applying a pressing force in the axial direction of the hollow shaft member. Such a process is not disclosed or suggested in the Sadakata reference. Sadakata discloses an elastic universal joint including a torque transmission member having radially protruding segments that is integral with a hollow shaft member that may be formed by cold forging working, etc. (column 13, lines 43-46). However, the use of axial pressure in such cold working is not explicitly disclosed.

The rejection of Claims 4 and 7 under 35 U.S.C. § 112 is moot in view of the cancellation of those claims.

Regarding newly presented Claims 8 and 9, Sadakata does not teach the use of low carbon steel as in the claimed invention. The advantages associated with the use of low carbon steel will be appreciated from Applicants' specification.

In view of the above amendments and discussion, this application is believed to be in condition for allowance, and an early Notice of Allowance is respectfully requested.

The Commissioner is hereby authorized to charge to Deposit Account No. 50-1165 any fees under 37 C.F.R. § 112


1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been requested separately, such extension is hereby requested.

Respectfully requested,

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Marked-up copy of Paragraphs - 09/904,908

Page 1:

Please substitute the following paragraph for the paragraph beginning at line 20:

A steering apparatus of a car, or the like, is comprised of a steering wheel to be used for steering operation of the driver, a steering gear for steering the wheels of the car, and a steering shaft used for coupling the steering wheel and the steering gear. Then, in the steering apparatus of a car, the steering gear is seldom positioned on the center axial line of the steering wheel, so that a plurality of steering shafts which are coupled to each other by [a] universal [joint] joints are often used. As the universal joint for the steering shafts, a Cardan joint having a cross piece (cross shaft) which is inserted between a pair of coupling elements to be rockable is generally used, as disclosed in the U.S. Patent No. 3501928.

Page 2:

Please substitute the following paragraph for the paragraph beginning at line 8:

Recently, in order to reduce [a] transmission of [a] kickback, or the like, from a road surface to the steering wheel, an elastic shaft coupling which employs an elastic member such as synthetic rubber is proposed,

as in the Japanese Patent Application Laid-Open No. 10-89373. In an elastic shaft coupling of this type, one of the coupling elements of the Cardan joint is divided into a joint member (i.e., a yoke) and a shaft, and an elastic ring formed of synthetic rubber, or the like, is inserted between the yoke and the shaft. In order to prevent damage, or to improve the durability of the elastic ring, a stopper portion for restricting a relative rotation within a predetermined amount is formed between the yoke and the shaft.

Page 3:

Please substitute the following paragraph for the paragraph beginning at line 24:

If the stopper portion and the shaft have the same diameter size, the forming machine requires a metal mold corresponding to the total length of the shaft, so that a large number of metal molds are required to be manufactured when a large kinds of products are to be produced on a small-lot basis. As a result, the unit cost of a small-lot products inevitably exceeds an allowed range if [including] the [producing] production cost of such molds is included. Further, when a

collapsible mechanism against a secondary collision [for] by a [crew] driver is provided in a coupling element, as disclosed in the Japanese Patent Application Laid-Open No. 8-91230, the shaft is formed in the shape of a pipe so that the steering shaft can advance into the shaft. However, the processing therefor requires a large number of steps, thereby increasing the manufacturing cost of the shaft.

Page 5:

Please substitute the following paragraph for the paragraph beginning at line 23:

Also, according to a second aspect of the present invention, in the elastic shaft coupling of the first aspect, the stopper portion on the hollow shaft member side may be provided with a rib for reinforcement, so as to enhance the strength and the rigidity of the base end [side] of the stopper portion by the reinforcing rib.

Page 6:

Please substitute the following paragraph for the paragraph beginning at line 3:

Also, according to a third aspect of the present invention, in the elastic shaft coupling of the first or second aspect, the outer diameter of the stopper portion on the hollow shaft member side may be made smaller than the outer diameter of the stopper portion on the joint member side, so that since an amount of the plastic processing for forming the stopper portion on the hollow shaft member side is small, a defect such as a crack is difficult to occur and, at the same time, a stress on the base end [side] of the stopper portion at [the] a stopper strike can be reduced.

Please substitute the following paragraph for the paragraph beginning at line 15:

According to a fourth aspect of the present invention, the elastic shaft coupling of the first or second aspect is arranged such that the stopper portion on the joint member [side] is brought into contact with the stopper portion on the hollow shaft member [side] from the center thereof in response to the relative rotation mentioned above so that the stress on the base end [side] of the stopper portion at [the] a stopper strike [can be] is reduced.

Page 10:

Please substitute the following paragraph for the paragraph beginning at line 1:

The shaft 13 is composed of a front tube portion 21 having a comparatively large diameter, a rear tube portion 31 having a comparatively small diameter, and a pair of stopper portions 33 formed at the tip end of the front tube portion 21. The stopper portions 33 are bent and raised each into the form of a flange at an interval of 180° from the front tube portion 21, so as to face stopper portions 35 of the partner yoke 3 with a predetermined gap therebetween. In this case, a pair of stopper portions may be bent and raised once each to have the entire circumference in the form of a flange and then trimmed into the form of a stopper. Each of the stopper portions 33 is formed to have at the end portion thereof reinforcement ribs 37 which are provided on the base portion along the circumferential direction, and has [the] an outer diameter D1 which is significantly smaller than the outer diameter D2 of the stopper portion 35 of the partner yoke 3.

Page 11:

Please substitute the following paragraph for the paragraph beginning at line 11:

Description will be made below [on] of a mode of operation of the first embodiment.

Please substitute the following paragraph for the paragraph beginning at line 13:

When the driver conducts a steering operation [at] while driving or receives a kickback [supplied] from the road surface, a relative rotation is generated between the yoke assembly 1 and the partner yoke 3 due to a rotational reacting force in the Cardan joint. Then, when this relative rotation is small, the synthetic rubber 25 of the elastic ring 15 is flexed and deformed, so as to prevent unpleasant shimmy or shock from being transmitted to the hand of the driver. However, when an amount of the relative rotation exceeds a predetermined value [at] in a sudden steering operation, or the like, the stopper portions 33 on the shaft 13 [side] and the stopper portions 35 on the yoke 11 [side] cause a so-called stopper strike, thereby preventing [a] damage [of] to the elastic ring 15 (synthetic rubber 25) due to an

excessive flexion or deformation, or reduction of the durability thereof.

Page 12:

Please substitute the following paragraph for the paragraph beginning at line 3:

In this case, a shearing stress is applied on the stopper portions 33 on the shaft 13 side. However, for the stopper portions 33 of the present embodiment, the reinforcement ribs 37 are formed at the base portion thereof, the outer diameter D1 is formed small, and the thickness t1 of the root portion is formed large. As a result, the strength of the base portion [on] at which the stress is liable to concentrate is formed [conspicuously] significantly higher than that of a conventional one, whereby damage or deformation hardly occur. Moreover, since being formed of a comparatively light steel pipe, the shaft 13 can be made remarkably lighter at a far lower cost than a shaft produced by the conventional forming machine. In addition, it is no longer required to form a hole through which the steering shaft 8 is to be passed.

Please substitute the following paragraph for the paragraph beginning at line 19:

Fig. 7 and Fig. 8 are cross sectional views for showing a yoke assembly 1 according to a second embodiment of the present invention, in which Fig. 7 shows the yoke assembly 1 in the normal state, while Fig. 8 shows [a] the state at [the] a stopper strike. The entire structure of the second embodiment and the mode of operation thereof are substantially the same as those of the first embodiment described above, except that the reinforcement ribs 37 are disposed along the entire circumference of the yoke assembly and the strength of the stopper portion 33 is further enhanced.

Page 13:

Please substitute the following paragraph for the paragraph beginning at line 4:

Fig. 9 and Fig. 10 are cross sectional views for showing a yoke assembly 1 according to a third embodiment of the present invention, in which Fig. 9 shows the yoke assembly 1 in the normal state, while Fig. 10 shows [a] the state at [the] a stopper strike. The entire structure of the third embodiment and the mode of

operation thereof are substantially the same as those of the second embodiment described above, except that the breadth B1 of the stopper portion 33 on the shaft 13 side is larger than the breadth B2 of the stopper portion 35 on the yoke 11 side, so that the strength of the stopper portion 33 is further enhanced.

Please substitute the following paragraph for the paragraph beginning at line 17:

Fig. 11 is a longitudinal cross sectional view for showing a yoke assembly 1 according to a fourth embodiment of the present invention, and Fig. 12 and Fig. 13 are cross sectional views taken along the line B-B in Fig. 11 corresponding to the normal state and [a] the state at [the] a stopper strike. The entire structure of the fourth embodiment and the mode of operation thereof are substantially the same as those of the foregoing embodiments, except that a stopper hole 51 having a substantially square shape is formed on the yoke 11 while a stopper portion 33 having a deformed octagonal shape is formed on the shaft 13 to be corresponding to this stopper hole 51.



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2 Marked-up Copy of Claims - 09/904,908

1 2. (Amended) An elastic shaft coupling [according
2 to claim 1, wherein] comprising:

3 a joint member formed with a hole;

4 a hollow shaft member formed of a steel pipe received
5 in the joint member;

6 an elastic member interposed radially between the
7 joint member and the hollow shaft member to flex and deform
8 upon relative rotation between the joint member and the
9 hollow shaft member;

10 stopper portions provided, respectively, on the joint
11 member and the hollow shaft member to restrict the relative
12 rotation therebetween within a predetermined amount; and

13 the stopper portions provided on said joint member
14 each including a pair of stopper faces spaced from each
15 other in a peripheral direction to form a gap therebetween,

16 the stopper portions provided on said hollow shaft
17 member each being radially outwardly projected into said
18 gap formed between said stopper faces of the corresponding
19 stopper portion provided on said joint member,

20 said stopper portions on said hollow shaft member
21 being formed by plastically processing an end of the hollow
22 shaft member to be projected radially outwardly, and
23 the stopper portions on said hollow shaft member
24 [side are] being provided with ribs for reinforcement.

1 5. (Amended) A method of manufacturing a coupling
2 element which is formed by interposing between a joint
3 member and a hollow shaft member an elastic member for
4 flexing and deforming upon a relative rotation between
5 these members and forming stopper portions for
6 restricting the relative rotation within a predetermined
7 amount respectively on the joint member and the hollow
8 shaft member, comprising the step of:
9 forming each of the stopper portions on said hollow
10 shaft member [side] into the shape of a flange while
11 applying a pressing force in the axial direction onto
12 said hollow shaft member.

1 6. (Amended) An elastic shaft coupling according
2 to Claim 2, wherein the outer diameter of [the] each said
3 stopper portion on said hollow shaft member [side] is
4 formed smaller than the outer diameter of the

5 corresponding stopper portion on said joint member

6 [side].